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ABSTRACT

A study investigated the effect of providing students with varying forms of feedback during reading on students' estimates of understanding, actual comprehension scores, and students' use of rereading and reading rate adjustment. The 67 subjects were presented with passages to read, and their reading behavior was monitored via computer. Although students became more accurate in their estimates of understanding across the four passage segments (reduced illusion of knowing), results indicated no effects of feedback on either comprehension or the processing measures. Findings suggest the relative resistance of metacognitive aspects of reading to short-term intervention among practiced readers. (Six tables of data are included. (MG)

The Effect of Feedback on the Illusion of Knowing and Comprehension Monitoring of College Students

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Abstract

This study investigated the effect of providing students with varying forms of feedback during reading on students' estimates of understanding, actual comprehension scores, and students' use of rereading and reading rate adjustment. Passages were presented, and reading behavior monitored, via computer. Although students became more accurate in their estimates of understanding across the four passage segments (reduced illusion of knowing), results indicate no effects of feedback on either comprehension or the processing measures. Results are discussed in terms of the relative resistance of metacognitive aspects of reading to short-term intervention among practiced readers.

Metacognition is a term which refers to the knowledge concerning cognitive processes or products (Brown, 1980). One aspect of metacognition is the ability to regulate cognitive processes. These regulatory processes include planning, evaluating, analyzing, and monitoring. In the area of reading, the term metacognition refers to metacomprehension. When the goal of reading is comprehension, most of the cognitive monitoring that follows is comprehension monitoring.

The monitoring of understanding has emerged as a concern to researchers in the area of metacomprehension. Comprehension monitoring refers to the ability to regulate ongoing comprehension processes. Throughout the literature, two components of comprehension monitoring have been identified. The evaluation component involves checking one's current state of knowledge and keeping track of the success or failure of comprehension processes. The second component is that of regulating comprehension processes. The individual must ensure that comprehension proceeds smoothly and implement appropriate corrective strategies to remediate comprehension failure. Those who monitor successfully know how to test whether understanding is adequate and how to deal with comprehension difficulties. Some strategies used to remediate comprehension difficulty include self-questioning, pausing, and re-reading.

Comprehension monitoring has great educational relevance. The monitoring of comprehension processes provides information which a learner may use to make decisions about areas of study, level of understanding, and to detect when further clarification is needed. Without this knowledge, an individual lacks vital information necessary to reach a level of more complete understanding.

Numerous studies have investigated the relationship between the use of comprehension monitoring strategies while reading and comprehension of the text. Results from research involving children (Garner & Reis, 1981; Grabe & Mann; Paris & Meyers, 1981) and adults (Baker, 1979; Baker & Anderson, 1982; Nist, Simpson, & Hogrebe, 1985) indicate a strong correlation between test scores and the use of appropriate strategies.

Evidence is gathering which indicates that the perception of understanding is related to the use of comprehension monitoring strategies. Awareness of comprehension failure provides a basis for implementing remedial strategies to enhance comprehension (Garner, 1980). Related to this issue is the concept of the illusion of knowing (IK). This term is used to describe the belief that comprehension has been attained when, in fact, comprehension has failed. It is evident that many learners do not assess their understanding of information accurately (Baker, 1979; Garner, 1980; and Markman, 1979). As additional support for the illusion of knowing, minimal correlation was found between ratings of understanding and performance on a comprehension measure for both factual and inferential material (Garhart and Hannafin, 1986).

Statement of the Problem

The fact that learners think they understand when they do not, or ignore their lack of comprehension, suggests ineffective monitoring of their comprehension. If the perception of understanding is related to the use of comprehension monitoring

strategies, and the use of these strategies is related to more accurate comprehension, then increasing the accuracy of the perception of understanding may result in an increase in comprehension monitoring behaviors. Some evidence suggests that providing feedback during reading may be effective in promoting learning (Carnine, Stevens, Clements, & Kammenui, 1982) and self assessment of understanding (Garhart & Hannafin, 1986).

The current research investigated the effect of feedback on the illusion of knowing, monitoring behaviors, perceived comprehension and comprehension performance.

Method

Design: The design selected for this study was a 4 (Feedback Groups) X 4 (Passages) mixed factorial design. Feedback Groups was a between subjects factor while Passage Segments was a within subjects factor. Subjects were randomly assigned to one of the four groups. Group 1 read the four passage segments then rated their comprehension (read only control). Group 2 read the four passage segments, rated their comprehension, and completed the comprehension measure (no feedback control). Group 3 read the passage segments, rated their comprehension, completed the comprehension measure, and received accurate feedback concerning their performance. Group 4 was the same as Group 3 except they received controlled negative feedback about their performance (the nature of the controlled feedback will be discussed below).

Subjects: The 67 experimental subjects were volunteers drawn from a screening group of 265 participants. The 67 experimental subjects included 19 males and 48 females. The average age of the subjects was 20.5 years. The subjects were randomly assigned to four groups. The initial number of subjects per group was 17 in Groups 1, 3, and 4 and 16 in Group 2. Two female subjects, one from Group 3 and one from Group 4 were eliminated from the study due to errors they made in operating the computer during the session which rendered their data uninterpretable. One subject from Group 1 was randomly eliminated from the study to obtain equal n's of 16 in each group Scores of the experimental subjects on the Nelson Denny comprehension and vocabulary tests averaged 23.76 and 66.89 respectively. These scores are comparable to those of the

remaining screening population. There were no significant differences between groups with respect to comprehension scores.

Experimental Materials

Passage Segments. Each subject was asked to read four passage segments, presented via computer. These passages were adapted from Garhart and Hannafin (1986). They were arranged sequentially. The content concerned the discovery of a fictional ore (berkelium oxide) on an imaginary South Seas Island. The details of the material were fictitious to avoid influences of prior knowledge. In addition, the content was designed to avoid logical conflicts with concepts in the areas of history, economics, anthropology, and mineral science. The material included a high information density within each passage to require students to sort among numerous facts and concepts. These passages were selected to ensure the presentation of sufficient information and to pose a challenge to the college reader. Previous data indicate the perceived comprehension of the passages to be between 6.19 and 6.75 on a scale of 10.

Assessment Measures

Comprehension Measure. Ten five-choice multiple choice questions were constructed for each of the four passage segments to measure subjects' comprehension of that passage. These questions were adapted to a multiple choice format from short answer questions used by Garhart and Hannafin (1986). Results of a pilot study indicated that the total item difficulty level was .58. The item difficulty levels of each set of ten questions ranged from .51 on segment 3 to .62 on segment 1. A KR-20 reliability estimate of .79 was obtained for the set of questions from pilot data.

Questions involved the comprehension of material in the text and required the ability to explain, interpret, and evaluate information. They were designed to be challenging enough for the student so that comprehension monitoring/fostering activities would be useful. The reliabilites of the four comprehension measures were computed with the data from the experimental subjects. The results yielded reliability estimates which ranged from .78 for the questions of passage segment 1 to .85 for the questions of passage segment 4.

Procedure: Subjects were seen in groups of up to five for a one-hour experimental session. Subjects were told that they would be reading four passage segments. Each segment would be presented one sentence at a time on an Apple IIe micro-computer. Subjects were able to regulate the presentation of the text by pressing the "next" key (coded green) to go forward and the "back" key (coded red) to go backward within the passage segment.

Subjects in all groups were informed that they would be asked to rate their comprehension of each passage segment on a scale from zero (do not understand) to ten (understand perfectly) after reading the passage segment, and to type their rating into the computer when asked to do so. Due to the subjective nature of "understanding" students may rate their comprehension based on differing criteria. In order to clarify the rating task, instructions regarding how to rate their comprehension were handed out to each student. These included brief explanations of the numerical ratings of the scale for subjects to refer to during the session. A reliability estimate of the comprehension ratings based on the data of the experimental subjects yielded a coefficient alpha of

.836.

Subjects in Groups 2, 3, and 4 were told that, after rating their comprehension, they would be asked to answer ten multiple choice questions pertaining to the material in that passage only. The multiple choice questions were presented one at a time on the computer, and the subjects were instructed to indicate their answer by pressing the appropriate key for that response. After completing the questions for the first passage, the subjects proceeded to passages 2, 3, and 4 at their own rate.

Subjects in Groups 3 and 4 received feedback after answering each set of ten questions. Subjects in Group 3 received accurate feedback regarding their performances on the questions after answering each set of ten questions. This feedback involved informing them of the number of questions they answered correctly out of ten. Subjects in Group 4 received controlled negative feedback after answering each set of ten questions. If the subject's actual score was less than or equal to six, then he/she received accurate feedback. When the subject's score exceeded six, the feedback he/she received was "six correct." This ensured that the maximum reported score any individual in Group 4 received was no more than six.

Dependent Measures: The comprehension ratings of each subject in all groups were recorded. The performance of subjects in Groups 2, 3, and 4 on the comprehension questions were recorded as the number of questions answered correctly out of ten for each passage segment.

Two aspects of comprehension monitoring were recorded for all subjects. The computer kept track of the use of rereading (number of regressions made within each

passage segment), and the average reading rate in words per minute was computed for each passage segment.

A final measure derived from subjects in Groups 2, 3, and 4 is an illusion of knowing (IK) score. This was represented by the difference between a subject's estimate of comprehension and his/her actual performance on the comprehension measure for each passage segment. Greater difference scores indicated a greater IK, smaller difference scores indicated a smaller IK.

RESULTS

Illusion of Knowing: A 3 X 4 (Group X Passage) mixed factorial analysis of variance (ANOVA) was performed with IK scores as the dependent variable. Table 1 presents the cell means and standard deviations for this analysis. The ANOVA yielded a significant main effect for Passage ($F(3,135) = 8.89$, $p < .01$).

The IK was obtained by subtracting a subject's comprehension score from his/her comprehension rating for each passage segment. A positive score indicated that the subject overestimated his comprehension. A negative score indicated an underestimation of comprehension.

The WSD follow-up tests indicated the mean IK score for Passage 4 ($X = -.67$) to be significantly lower than the mean IK score for Passage 1 ($X = .29$), Passage 2 ($X = .98$), and Passage 3 ($X = .29$). No significant differences were found between Passages 1, 2, and 3.

Table 1
Means and Standard Deviations for Groups on IK Scores

	Passage 1		Passage 2		Passage 3		Passage 4	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Group 2	.38	2.39	1.69	1.66	.75	1.06	-.56	1.71
Group 3	-.06	1.95	.31	1.06	.06	2.05	-1.90	2.26
Group 4	.56	1.79	.94	2.08	.19	2.01	-.25	1.65

N for all cells equalled 16

Reading Rate: A 4 X 4 (Group X Passage) mixed factorial ANOVA was performed with RR in total words per minute as the dependent variable. The ANOVA yielded no significant effects. The cell means and standard deviations for this analysis are included in Table 2.

Table 2
Means and Standard Deviations for Groups on RR

	Passage 1		Passage 2		Passage 3		Passage 4	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Group 1	109.25	26.16	130.44	33.65	120.94	29.07	128.44	36.35
Group 2	117.63	78.35	114.38	28.80	111.38	36.09	108.63	30.06
Group 3	109.94	35.50	115.06	44.80	102.50	26.44	102.94	25.01
Group4	117.81	23.82	128.69	34.73	117.00	27.91	129.13	29.46

N for all cells equalled 16

Regressions: A 4 X 4 (Group X Passage) mixed factorial ANOVA was performed with REG as the dependent variable. The ANOVA yielded a significant main effect for passage ($F(3,180) = 4.47$, $p < .01$). The means and standard deviations for this analysis are presented in Table 3.

The WSD follow-up tests indicated the mean number of regressions for Passage 2 ($X = .56$) to be less than the mean number of regressions for Passage 1 ($X = .83$), Passage 3 ($X = 1.25$), and Passage 4 ($X = .95$). The mean number of regressions for Passage 3 was also found to be significantly greater than Passages 1 and 4. The mean number of regressions for Passages 1 and 4 were not significantly different.

Table 3
Means and Standard Deviations for Groups on REG

	Passage 1		Passage 2		Passage 3		Passage 4	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Group 1	1.06	1.69	.75	1.18	1.19	1.33	.69	1.01
Group 2	.81	1.33	.44	.63	1.19	2.34	1.19	1.43
Group 3	.75	1.00	.69	1.01	1.44	1.55	1.13	1.31
Group 4	.69	1.35	.38	.72	1.19	2.04	.81	1.17

N for all cells equalled 16

Comprehension Scores: A 3 X 4 (Group X Passage) mixed factorial ANOVA was performed with CO scores as the dependent variable. The ANOVA yielded a significant main effect for Passage ($F(3,135) = 5.35$, $p < .01$). The means and standard deviations are presented in Table 4.

The WSD follow-up tests indicated the mean comprehension score for Passage 4 (X = 6.75) to be greater than the mean comprehension score for Passage 1 (X = 5.81), Passage 2 (X = 6.10), and Passage 3 (X = 5.98). There were no significant differences between Passages 1, 2, and 3.

Table 4
Means and Standard Deviations for Groups on CO

	Passage 1		Passage 2		Passage 3		Passage 4	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Group 2	5.88	2.03	5.75	1.13	5.69	1.30	6.81	1.33
Group 3	5.81	1.38	6.31	2.02	6.06	1.88	6.94	1.65
Group 4	5.75	1.24	6.25	1.65	6.19	1.11	6.50	1.67

N for all cells equalled 16

Comprehension Ratings

A 4 X 4 (Group X Passage) mixed factorial ANOVA was performed with CR as the dependent variable. The ANOVA yielded a significant main effect for Passage ($F(3,180) = 10.95$, $p < .01$). The means and standard deviations are presented in Table 5.

The WSD follow-up tests indicated the mean comprehension rating for Passage 2 (X = 7.11) to be significantly greater than the mean comprehension rating for Passage 1 (X = 6.14), Passage 3 (X =6.25), and Passage 4 (X = 6.22). There were no significant differences between mean ratings for Passage 1, 3, and 4.

Table 5
Means and Standard Deviations for Groups on CR

	Passage 1		Passage 2		Passage 3		Passage 4	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Group 1	6.25	2.35	7.13	1.71	6.13	1.50	6.63	1.86
Group 2	6.25	1.91	7.50	.97	6.56	.96	6.25	1.24
Group 3	5.75	1.69	6.63	1.31	6.00	1.63	5.75	2.05
Group 4	6.31	1.58	7.19	1.56	6.31	1.78	6.25	1.73

N for all cells equalled 16

Due to the fact that there were no Group effects nor Group X Passage interactions found, it was decided to investigate the correlations between Comprehension Ratings and Comprehension Scores. Table 6 presents the correlation matrix for CR and CO.

Table 6
Correlation Matrix for CR and CO

	CO1	CO2	CO3	CO4
CR1	.23	.11	.12	.24
	.11	.46	.41	.10
CR2	.22	.06	.17	.36
	.13	.67	.26	.01
CR3	.21	.03	.27	.41
	.15	.83	.06	.004
CR4	.22	.18	.51	.30
	.14	.21	.003	.04

Four significant correlations were found, three of those being off the diagonal. The only significant diagonal correlation was that between CR4 and CO4.

Conclusions

The current research attempted to determine the effect of feedback on subjects' IK and monitoring behaviors. It was hypothesized that subjects who received feedback regarding their performance on a comprehension measure would show a decrease in IK and would increase their use of monitoring strategies.

It appeared that providing feedback had little effect on the subjects' IK, as the groups did not significantly differ. This suggests the impotence of short term feedback on altering subjects' behaviors. Results did indicate, however, a convergence of performance and perception for all subjects on the fourth passage segment. Although direct feedback did not effect subjects' IK, it is possible that as students gained experience with the comprehension questions, they were better able to estimate their understanding which resulted in this convergence. It is highly unlikely that the lack of significant differences between the groups with respect to IK was due the measures since both had high calculated reliability.

The correlations between comprehension ratings and comprehension scores for each passage segment yielded results consistent with the findings of Garhart and Hannafin (1986). The correlation was not significant until the fourth segment, but the effect appeared to be progressive from segment 3 to 4. This provides additional support for the idea that as students gained experience with the questions they were better able to predict their performance on subsequent segments.

Informing the subjects of how many items they missed on the comprehension measure also proved to have little effect on subjects' reading rate and use of regressions.

One possible explanation centers around the notion that comprehension monitoring behaviors are acquired over a long period of time. Thus, they are not likely to be changed in a sixty-minute session. Although the subjects were aware of performing poorly and may have wanted to improve, it is unlikely that they would suddenly change routinely employed strategies. Additionally, initiation of additional comprehension monitoring activity may be triggered by internal evaluation operating when Illusion of Knowing is recognized concurrent with reading. Since feedback was provided after a segment, such may not have affected evaluation of subsequent segments.

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